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ABSTRACT

A design for improving the quality of information available for continuous operational study of student retention at the University of Hartford in Connecticut was examined involving a microcomputer based decision support system for student retention research. The system, an interactive modeling approach to conduct longitudinal and comparative studies, used multi-year admissions, financial aid, and academic data integrated with student surveys of college adjustment, reasons for leaving, student involvement, and college experience. The system enabled users to model attendance patterns and degree attainment for selected student subpopulations. Improvements in the system were considered necessary in order for it to provide feedback that is timely, not only for purposes of research, but for operational use in improving student recruitment and retention strategies. Contains 12 references. (GLR)

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An Interactive Model For Studying Student Retention

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Abstract

Student retention research has a long history in higher education, but only recently have research findings been synthesized to build theories of student withdrawal, to apply those theories to longitudinal and comparative studies, and to use the results to diagnose problems and devise strategies for increasing student retention. This paper describes the design of a microcomputer based decision support system for student retention research that uses an interactive modeling approach to conduct longitudinal and comparative studies using multi-year admissions, financial aid, and academic data integrated with student surveys of college adjustment, reasons for leaving, student involvement, and college experience.

An Interactive Model For Studying Student Retention

Conceptual Framework for Design

The conceptual framework for the design is based on recent reviews of the student retention literature (Tinto, 1987; Noel et al, 1983; Hossler, 1984; Pascarella, 1982). Tinto recognized the importance of the interactions that take place over time between individual students and the academic and social systems of particular colleges. A student's decision to pursue a degree at a particular college starts with the skills, abilities, interests, prior school experience, and family background the student brings to the campus, and his expectations about what he will experience as a student in that college. The motivation to persist towards successful completion of a degree in that college very much depends on the student's becoming involved in the academic and social life of the college, achieving a satisfactory academic record, and forming satisfying relationships with faculty, students and staff at the college. Colleges vary widely in their admissions selectivity, intellectual orientations, academic demands, social life, and campus environment. Consequently, at any point in time, the college's requirements and academic and social climate may be a good match or poor match with the expectations of a particular student or student subculture.

From national longitudinal studies of degree attainment, it is clear that prestigious institutions that practice selective admissions have much higher rates of student retention and degree attainment. Furthermore, over the entire range of College Board SAT scores and high school class rank, academic measures are highly correlated with retention based on high and low admissions selectivity among colleges. (Dey & Astin, 1989) Changing the admissions selectivity of a college requires a long-range effort to have any major impact on student retention; moreover, nearly 85 percent of the departures from college are voluntary and most students leave in good academic standing (Tinto, 1985). Reasons for students leaving college vary widely and may be as difficult for an experienced counselor to interpret, as it is for the student, without adequate longitudinal data and significant dialogue about the student's adjustment, involvement, and response to academic and social life at the college (Anderson, 1985). In order to diagnose student retention problems and to devise effective intervention strategies, colleges administrators and institutional researchers need to build a comprehen-

sive, multi-year longitudinal student database that incorporates both student records and student survey data. They also must have access to easy to use, flexible and powerful tools for performing analyses and reporting the results of student retention studies.

Methodology and Approach

This paper describes the design and implementation of an interactive decision support system (DSS) that enables users to model attendance patterns and degree attainment for selected student subpopulations. Using this, DSS longitudinal and comparative studies of retention were prepared for the 1984 entering student cohort for selected student subpopulations in each of the University's eight colleges. The implications of this interactive modeling system are discussed in the context of enrollment management and institutional research practice.

Research from the literature on student retention, together with a simple set of design concepts, guided the development of the student retention decision support system. The student tracking database for each student cohort was created by integrating data from each student's admissions application and financial aid records with each semester's attendance and grade performance record accumulated over a six year period. Academic prediction studies were performed using multiple linear regression to derive prediction equations and to determine the accuracy with which first semester grades can be predicted for each college subpopulation. Retention or withdrawal now can be monitored each semester for high academic risk student subpopulations to assess their academic adjustment.

A new survey instrument, Student Adaptation to College Questionnaire (Baker & Siryk, 1989), will be administered this fall to entering students several weeks into the semester to assess each student's academic, social, and personal-emotional adjustment, and his/her identification or attachment to the college and university. Data on student involvement will be gathered unobtrusively through student activity rosters and a student leadership transcript program. A follow-up survey will be sent to students withdrawing from the university each semester to obtain information about their reasons for leaving, and requests for transcripts will be monitored to learn about student plans for transferring to another college. Multivariate analysis procedures, including cluster, discriminant ,and log-linear analysis, will be used to predict retention from traditional biographic/demographic and academic data, and from the student adaptation survey data gathered for freshmen and transfers in each college and for selected student subpopulations. Analyses will be performed using a decision sup-

port system that enables users to test hypotheses about high and low risk student subpopulations using simple menus and screens to select databases, student subpopulations, and methods of analysis for each longitudinal comparison study.

Student Retention Tracking Database

The student retention database is created initially from Systems and Computer Technology's (SCT) Integrated Student Information System, which first became operational at the University in Fall, 1984. The student database that resides on the IBM 4381 mainframe includes student master records and detail records for each academic term, including data on prospective applicants, admissions applicants, student financial aid, student academic history, accounts receivable, and extracurricular activities. The mainframe database, while containing all of the necessary data elements for student retention tracking, is designed for efficiency in maintaining and viewing detail records for individual students, rather than being well integrated for flexible and responsive summary analysis and reporting.

Using a microcomputer based master data dictionary system, programmed in Foxbase, three Easytrieve programs are generated and uploaded to the IBM mainframe to select records and to format the necessary data fields for each academic term for an entering student cohort (e.g., all new full-time undergraduates entering in the fall term in 1984). The extracted records are down-loaded from tape to Bernoulli cartridge and imported through a Foxbase menu system to create the student retention tracking database. Using student social security number as the key for matching records, the applicant, financial aid, and student records are integrated to create the initial student retention tracking record. The student tracking record is processed through a Foxbase computation program that uses first semester accounts receivable data and student credit hours to validate which of the students who paid tuition deposits actually enrolled as full-time students in the entering cohort. Using social security number as the key, detail records for each academic term are then matched against each student master record to compute the student retention tracking history. Retention pattern variables are computed for each term indicating; 1) whether the student is enrolled full-time or part-time; and 2) whether the student is enrolled, not enrolled, has completed a two year degree, or has completed a four year degree. The length of each retention pattern variable, created by concatenating the coded value for each semester across academic terms, is determined by the number of academic terms of data that are available for an entering

cohort, for a maximum of six years or twelve semesters. The student retention record also keeps track of the student's college, major, credit hours and quality points earned, and semester and cumulative grade point average for each academic term the student is enrolled through graduation or departure during the six year time period.

Decision Support System

The Office of Planning and Institutional Research has developed a micro-computer based decision support system for college administrators that uses a report directory, data dictionary, and user-friendly menus and screens to control database and statistical analyses reporting, and to satisfy the user's information requirements with minimal programming assistance.

To execute a report request that already exists in the report directory, the user has only to scroll through organization, subject, and report menus, making a single choice at each menu level. A light-bar menu and up and down arrow keys are used to navigate through the report directory database to locate each menu choice. When the user's menu choice is highlighted by the light-bar, he hits the enter key to execute that selection. In the organization menu, the user selects the appropriate subject menu at the university, vice president, college, or department level, and enters the correct password to proceed to the next menu. From the subject menu the user selects student retention as the subject; this takes him to the report menu that lists all available student retention reports by student subpopulation, as requested at either the University or college level. Finally, the light-bar menu is used to scroll through the report descriptions to locate and highlight the user's selection, and the enter key is used to execute the analysis and produce the report the user has requested.

To create a new report request, or to modify an existing request, the user has only to enter the Common User Environment (CUE), a questionnaire type system of menus and screens, and respond to the prompts and questions on each screen. The CUE questionnaire responses are saved as report request parameters in a single record, uniquely identified by a report name and report description, in the report directory database. When the report name and report description are highlighted and the user hits the enter key, the appropriate database file will be processed using the correct database analysis, statistical analysis, or report program - all executed under the control of the parameters the user has previously entered in specifying the report request.

The CUE questionnaire asks the user for a report name, the name of the database file used for input, the directory and subdirectory where the file is located, and for a descriptive report title. Organization and subject level classifications are assigned and entered for each report request. Using a data dictionary, available in the form of a report or screen views, the user specifies the data fields and criteria for record selection, data fields used for sorting or indexing records, and data fields used in the analysis or reports. Alternatively, the user can select records for processing by naming a key file where keys (e.g., Social Security Number, fund number) in individual records are matched against the list of keys in the named key file (e.g., Social Security Numbers for financial aid recipients) to create a selected records file or to produce the report directly.

The user is prompted to select a type of report (e.g., database, statistical analysis, report form listing) from a list of available options, to provide a descriptive report title, to name the data file where selected records will be saved, to name the database or statistical program (i.e., report format) to use, and to name the print file where the results of the analysis can be accessed through Executive Information System (EIS) menus.

Academic Prediction Studies

Traditional academic prediction studies are used as the first phase of an early warning system that deals with the student's academic adjustment. Although national follow-up studies indicate that institutional admissions selectivity, scholastic aptitude tests and high school class rank predict college grades and student retention, each college or university has to perform its own validation studies to determine the predictive value of traditional academic measures for admissions selection and student retention. Multiple linear regression is the statistical method used to determine the optimum combination of weighted scores for predicting first semester grade point average from College Board SAT Verbal and Math scores and high school class rank. Having derived prediction equations (i.e., optimum combination of weighted scores for predictors), the equations are applied to each student's scores to obtain a predicted grade point average. The predicted grade point averages and actual first semester grade point averages are correlated in a cross-validation study to determine the predictive accuracy of the equations derived from the validation study.

Separate academic prediction studies are performed for freshmen in each college, because each of the eight colleges at the University is distinctive with respect to academic mission, curriculum, admissions selectivity, grading standards, and student retention. Fortunate-

ly, the CUE menu system makes it possible to select the student subpopulation for each college, to send the database to the SPSS-PC multiple linear regression program, to perform the necessary analysis, and to send the report results back where they can be viewed or printed from an EIS menu.

The first semester college grade point average is an appropriate measure of the student's academic adjustment during the transition period, and it correlates highly with the cumulative grade point averages of students who enroll in subsequent semesters. The problem for the University of Hartford is that first semester GPA can be predicted from SAT scores and high school class with reasonable accuracy (.50 to.65 multiple correlation) only for freshmen in four of the eight colleges. Data on SAT scores and prior college grade point averages are too incomplete to perform a reliable academic prediction study for transfers. Moreover, the large majority of students who leave the University are eligible to return. Some do have marginal grades, but others have grades that qualify them for transfer to highly selective colleges.

Student Adaptation to College

Student retention is a multifaceted process that can be understood only when information the college has about the student's biographical, demographic, and academic data are supplemented with surveys that enable students to share their perceptions about what they are experiencing in their adjustment to college life. During the early period of college, students experience a separation from their families, high school peers, and communities, and go through a period of transition before they can incorporate and feel comfortable with the values, attitudes, norms, and behaviors of the student subculture and the college they have selected (Tinto, 1989).

To supplement the information available for studying student retention, the University has selected a recently published questionnaire that was designed specifically to assess student adjustment to college, the Student Adaptation to College Questionnaire (SACQ; Baker & Siryk, 1989). SACQ is a 67 item, self report questionnaire that can be administered individually or in groups, and takes about 20 minutes to complete. The questionnaire is organized into four principal subscales, each of which focuses on a different aspect of student adjustment: 1) Academic Adjustment (24 items) deals with educational demands of the college experience; 2) Social Adjustment (20 items) pertains to interpersonal and social demands of college adjustment; 3) PersonalEmotional Adjustment (15 items) refers to how

the student is feeling psychologically and physically; and 4) Goal Commitment-Institutional Attachment (15 items) explores the student's feelings about being in college and attending the particular college he/she selected.

SACQ is being administered at the University under the direction of the Counseling Office to all freshmen and transfers entering in the Fall, 1989. A pilot test of the unpublished version of the instrument was given through the Art and Sciences Dialogue program a year ago, and preliminary research findings were encouraging in predicting student retention over the first two semesters. As the authors of SACQ have suggested, the Office of Planning and Institutional Research will conduct its own local validation studies following guidelines suggested by the research at Clark University. When the SACQ database is complete, a factor analysis will be performed to compare the locally validated factor scales with the factor scales used in scoring the instrument. Cluster analysis will be performed to create student subgroups that have similar adjustment profiles across the four scales and to identify high and low risk populations for student retention. Discriminant analysis studies will then be conducted to identify scales and items that predict group membership for: 1) different adjustment profiles, 2) high and low risk groups for student retention, 3) students continuing and leaving, 4) freshmen and transfers in each college. The SACQ database will also be integrated with the student retention tracking database which will make it possible to use interactive computing to perform statistical analyses or ad hoc queries for student subpopulations selected using any combination of predictors or criteria in the database.

Reasons for Leaving

Since over 85 percent of the students who leave college are in satisfactory academic standing when they leave, it is important to gather data on the student's reasons for leaving, either during the student's exit interview or as soon as possible after it becomes known that the student is leaving. When students are being counseled about their leaving, the counselor needs to discriminate between those situations where the student's educational, career, and personal goals are really better served by leaving or transferring to another college, and those situations where the institution is in a position to respond effectively, thus enabling the student to decide to continue his/her enrollment. If the institution is to take effective action, it needs to understand the types of adjustment problems students are having and why they decide to leave, not just to describe the biographic, demographic, academic, or extracurricular differences between students who stay or leave.

The University has administered surveys to departing students in the past, but now plans to revise that instrument to reflect recent research findings, to administer the instrument more systematically to increase response rates, and to incorporate reasons for leaving more directly into the student retention research program. A well balanced "reasons for leaving" questionnaire should present a comprehensive and representative list of reasons; one that parallels the factors encompassed in the Student Adaptation to College Questionnaire - academic, personal, social, and institutional reasons for leaving. The questionnaire should also make provisions for identifying how important each reason is to the student's decision to leave, asking the student to rank the three most important reasons for leaving, and using an open ended question asking for the student's impressions of his/her college experience.

Student Retention Patterns

Student retention patterns are analyzed using the CUE system of menus and screens and interactive computing to describe the retention patterns for user defined subpopulations of students in any entering cohort. The user only has to select the student retention database for the entering cohort, enter his selection criteria for selecting the student subpopulation for analysis, and the name of the Foxbase program that computes the pattern of enrollment and degree completion. The analysis program computes two tables in the same format. The rows are enrollment status and degree completion, and the columns are fall and spring semesters up to a maximum of six years of tracking data. The first table displays the number of students in each enrollment status and degree completion category by semester. The second table reports the percent of the entering student cohort in each enrollment status and degree completion category by semester.

Separate analyses of student retention are performed routinely for freshmen and transfers in each college to establish a base-line and to monitor progress in efforts to improve student retention. In the interest of brevity, we report only the patterns for all colleges combined. For the 1984 entering freshmen student cohort 46 percent had either earned a four-year degree or were still enrolled at the end of the fourth year. For transfers in the 1984 entering cohort 60 percent had either earned a four-year degree or were still enrolled at the end of the fourth year. Between 15 and 20 percent of the entering student cohort was lost during the first year, and another 15 to 20 percent in the second year, after which only between 5 and 10 percent leave. Based on national student retention data reported in (Dey & Astin, 1989), the University's student retention rate is normative for private, comprehensive univer-

sities of moderate admissions selectivity. However within the student enrollment mix of freshmen and transfers at the University, there is wide variation among colleges in student retention rates (35 percent to 67 percent) not all of which is explained by differences in admissions selectivity.

The advantages of using interactive computing to assess student retention patterns is readily apparent. Hypotheses about high and low risk student subpopulations can be tested by using any combination of variables in a user defined record selection statement and performing the student retention analysis for that subpopulation in a matter of a few minutes directly from the database without having to write a program. For example, the user could compare the student retention patterns of freshmen receiving financial aid in the college of arts and sciences with first semester GPA's above 3.0 with those having first semester GPA's below 2.2, to determine if the college is relatively successful in retaining its better students. Similarly, the user could compare the student retention patterns of students identified as high and low risk based on student responses to the Student Adaptation to College Questionnaire (Baker & Siryk).

Student Involvement

Astin and Pace have argued persuasively that active student involvement is the key to learning and personal growth in college, to student achievement and satisfaction, and as a result to student retention. (Astin, 1984; Pace, 1984) Their model of student involvement is as promising a research paradigm as any currently available for studying student retention. Research has demonstrated rather clearly that the breadth and quality of student involvement in selective liberal arts colleges and research universities is highly correlated with perceived gains from college experiences, with student satisfaction, with high student retention, and with high rates of alumni participation. (Pace, 1984; Astin, 1984) Relatively few colleges and universities have the admissions selectivity, the physical facilities, the quality of academic programs and student services, or the housing, athletic and extra-curricula facilities to match that high level of student involvement and quality of effort. Within the limits of its own resources, and the students it recruits, every college can seek effective ways to motivate students to become more actively involved in their own learning and personal growth.

Creating an environment where students are actively involved begins with student recruitment; identifying students who are interested, actively involved, and committed to improvement in some area of activity the college offers. For colleges that are moderately selec-

tive academically, it means finding students whose academic interests and abilities match the college's teaching strengths, and whose extracurricular interests and abilities match the college's offerings for student life. The student has to be sufficiently motivated to invest in his/her own learning; that is the student's responsibility. Given the resources the college has to offer, the college at the very least can help the student make the interpersonal and activity connections that build on motivations that are already there.

The University currently is exploring ways to study the impact of student involvement in extra-curricula activities and how that participation contributes to academic achievement, satisfaction with the college experience, and student retention for different student subcultures. Activity codes in the ISIS database can be downloaded for prospective students, applicants and enrolled students to track involvement in extracurricular activities. With this database it is possible to identify new students and returning students who share common interests, to help them to connect, and to pursue their interests actively while building friendships. The same activity database will be valuable for recruiting students for participation in extracurricular activities, for building a leadership transcript for students, for responding to NCAA compliance in monitoring intercollegiate athletics, for studying the impact of financial aid programs on student mix, and for assessing the impact of activity involvement on student satisfaction and retention.

Quality of Student College Experiences

Institutional effectiveness in student recruitment and retention ultimately depends on the perceptions prospective and enrolled students have of the quality of academic programs, administrative services, and physical facilities, and the feelings of stimulation, friendliness, warmth, and support that come from relationships with faculty, staff and fellow students.

Colleges and universities concerned about improving quality recognize the need to ask students to share their perceptions about the quality and value of their college experience. At the University of Hartford each college uses an instrument to gather data on student evaluations of instruction. Such instruments provide useful feedback to individual faculty members and department heads which helps them to increase teaching effectiveness within the department. With appropriate levels of summarization, student evaluations of instruction can also make a valuable contribution to improvement through program level reviews.

The American College Testing program has developed two survey instruments that appear promising for gathering student evaluations on the quality of the campus environment, physical facilities, and administrative services: 1) College Student Needs Assessment Survey, and 2) Student Opinion Survey. Questionnaires of this type should be especially useful as the University gathers data for an accreditation review which will take place within the division of student affairs next year.

The College Student Experience Questionnaire (Pace, 1984) is a unique self-report instrument for gathering data from students about the quality of their undergraduate education and examining the sources of student progress towards important goals of a college education. The instrument has a behavioral orientation the asks students how frequently they participate in each of a comprehensive list of learning activities which are widely available on college and university campuses. Quality of effort is measured by arranging the activities into hierarchical scales, with individual activity items at higher or lower levels on the scale depending on the time commitment and level of difficulty the activity represents. The student also is asked to assess the quality of his/her undergraduate experience and the progress made toward achieving important educational objectives. At the University of Hartford we plan to administer the College Student Experiences Survey as a senior survey for three purposes: 1) to perform an assessment of academic outcomes and administrative services, 2) to gain a better understanding of the benefits students gain from their activity involvement, 3) to stimulate student thinking about how to relate their undergraduate experience to careers and life after college, and 4) to identify students whose involvement as undergraduates suggest that they will be active contributors as alumni.

Executive Information System

The Executive Information System (EIS) is a user-friendly system of menus and screens designed to enable decision makers at the University to navigate through a comprehensive strategic planning and management information database to monitor external trends and institutional performance. Access to information is provided by linking report files to a light-bar menu system that is implemented using Lotus spreadsheet software. To access information, the decision maker has only to scroll through organization, subject, and report menus, making a single choice at each menu level. A light-bar menu and up and down arrows are

used to navigate through the reports that are available for viewing or printing. When the user's menu choice is highlighted by the light-bar, he hits the enter key to make his selection, and the requested information is immediately retrieved for viewing.

To illustrate the ease-of-use, flexibility, and power of the EIS system, here is an example of how a decision maker might use the system to gain a better understanding of student retention on his campus. The Vice President for Student Affairs uses the light-bar menu to select the University level of the organization menu. At the subject level, he selects "strategic plans" as the subject. He browses the enrollment management section of the University's strategic plan to review what the student retention situation is in each college. He navigates his way back to the subject menu and selects "student retention reports"; and from the list of available reports he proceeds to select and review student retention reports comparing a six year follow-up of freshmen in the 1984 entering student cohorts of Arts and Sciences with their counterparts in the College of Engineering. Having observed the differences in student retention rates between the two colleges at the end of the first semester, the vice president navigates his way back through the organization and subject menus to review the academic prediction studies of each college. He can then judge how accurately first semester grades can be predicted, and consider whether raising admissions standards might improve academic adjustment. The narrative interpretation and tables from that study suggest that higher admissions standards could improve retention, but it is not clear whether the students the colleges are losing are at the high or low end on academic performance. Returning to the subject menu again, he reviews the available student retention reports and sees that the type of analysis he wants has not been performed. The analysis he wants is only a telephone or electronic message away from the Office of Planning and Institutional Research or the Director of Counseling Services. By simply changing the record selection criteria in a couple of the decision support system report request screens the new information request can be processed in a matter of minutes, with the resulting reports accessible for review through the EIS menus when the report is produced. Using the same procedures, the decision maker can: 1) view or print the results of any database or statistical analysis report; 2) use a spreadsheet model to ask "what if" questions, print tables, or view graphs; 3) retrieve the text of strategic plans, annual reports, budget requests, committee reports, or institutional research studies; 4) review external trends and internal performance indicators in the form of tables, graphs and interpretive text.

Summary and Conclusions

This paper presents an overview of a design for improving the quality of information available for continuous operational study of student retention at the University of Hartford. The theoretical and conceptual frameworks currently available clearly are useful for the design of a comprehensive database for conducting longitudinal and comparative studies of student retention. The University is fortunate to have access to a comprehensive operational student database, and to a cost - effective decision support and executive information system that promises to deliver better and more timely information to decision makers. A successful student retention research program, however, requires more than operational student data. The database must be enriched with student surveys to provide feedback on student college adjustment, reasons for leaving, and quality of college experiences. Improvements will have to be made in our survey research system to provide feedback that is timely, not only for purposes of research but for operational use in improving student recruitment and retention strategies.

As in any research effort of this type, the University recognizes the importance of maintaining the security and confidentiality of individual student data, balanced against the necessity of providing information access to professional administrators, student counselors, and faculty advisors who have the responsibility of helping students take maximum advantage of the undergraduate experiences the college offers.

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